#s 1, 4, 6, 10, 11

(12) UK Patent Application (19) GB (11) 2 214 891 (13) A

(43) Date of A publication 13.09.1989

(21) Application No 8802613.3

(22) Date of filing 05.02.1988

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(51) INT CL⁴
B65D 23/08 83/14

(52) UK CL (Edition J)
B8D DCW23 D1A1 D1B1 D1B2 D1E D7PY D7P1
U1S S1459

(56) Documents cited
GB 1190241 A US 4342399 A

(58) Field of search
UK CL (Edition J) B8D DCD DCE DCW21 DCW23, F1R
INT CL⁴ B65D

(54) Containers for pressurized material

(57) A container for pressurized material eg an aerosol container comprises an inner vessel 2 formed from plastics material by stretch blow-moulding, and an outer sleeve 16 of rigid material secured to the side wall 8 of the inner vessel 2. The container may also comprise a cap 14 fitted flush with the outer sleeve 16. The outer sleeve 16 may be secured to the inner vessel 2 by adhesives, foamed plastics material, welding, ridges formed in one or both elements, annular gaskets, or by a friction fit. The external shape of the outer sleeve 16 may be different from that of the inner vessel 2. The sleeve may abut against a separate base cup (Figure 1). The inner vessel may be of PET and the outer sleeve formed by injection moulding high density polyethylene, polypropylene, polystyrene, nylon, PET, or a copolyester. The outer sleeve extends over at least 20% of the length of the side wall and provides protection, ease of surface printing and texturing, and barrier properties.

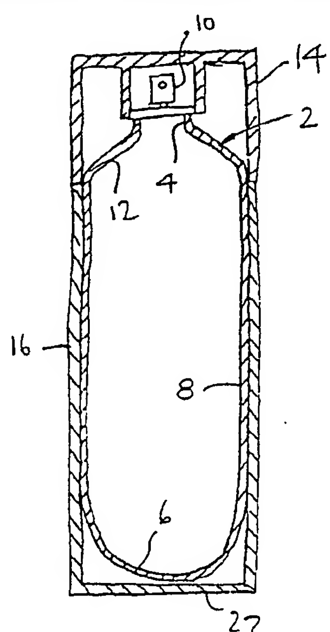

FIG. 2

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.
The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

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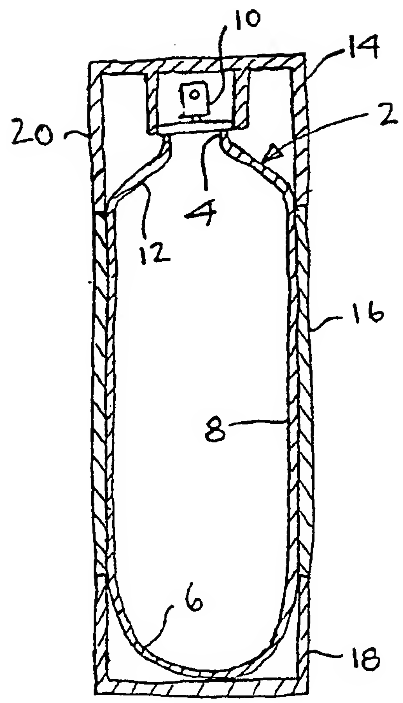

FIG. 1

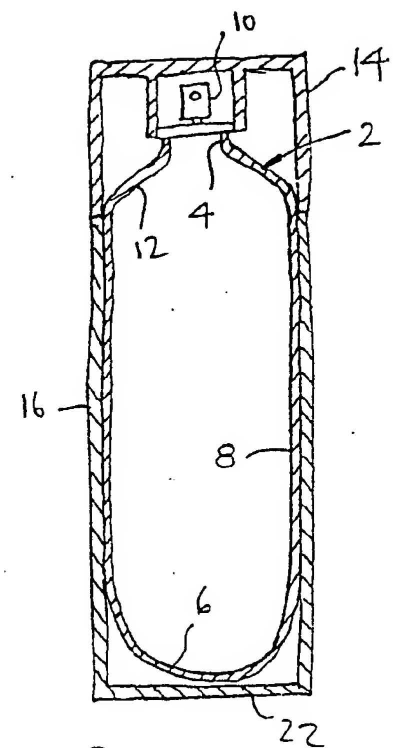

FIG. 2

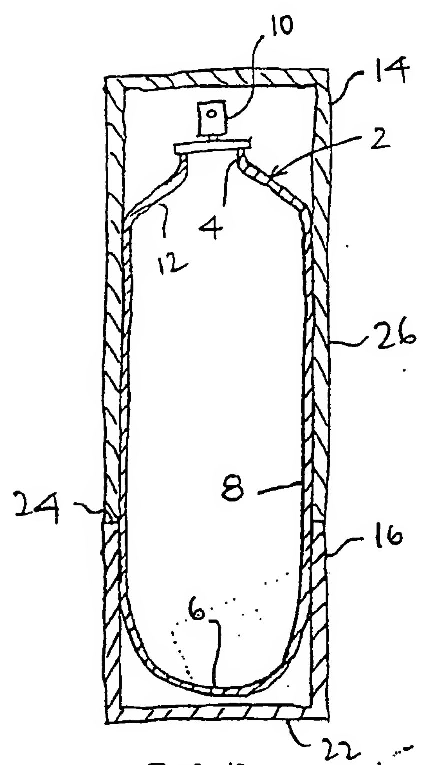

FIG. 3

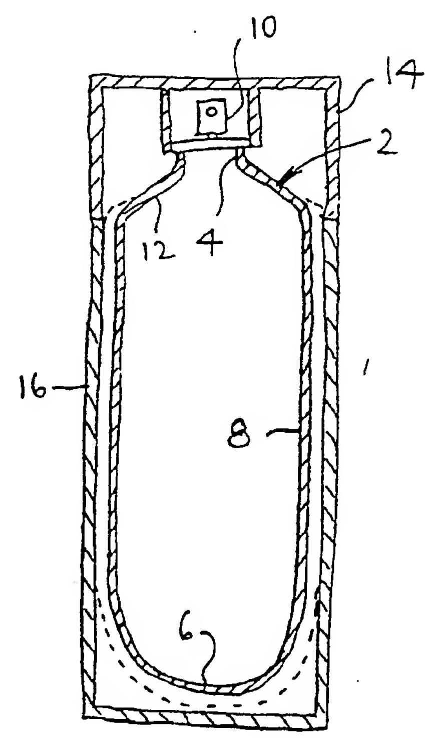

FIG. 4

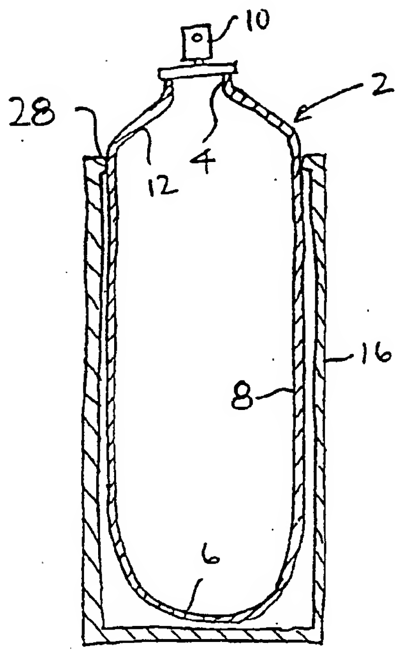

FIG. 5

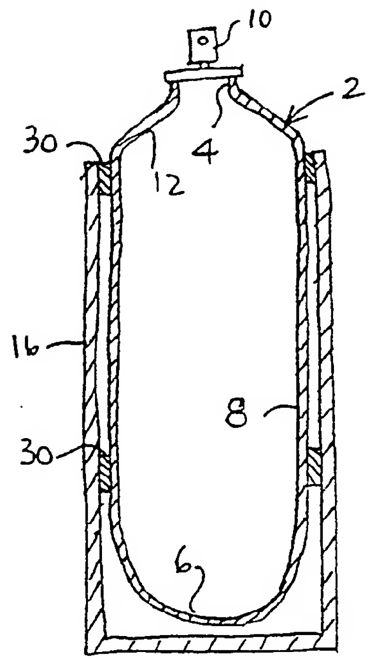

FIG. 6

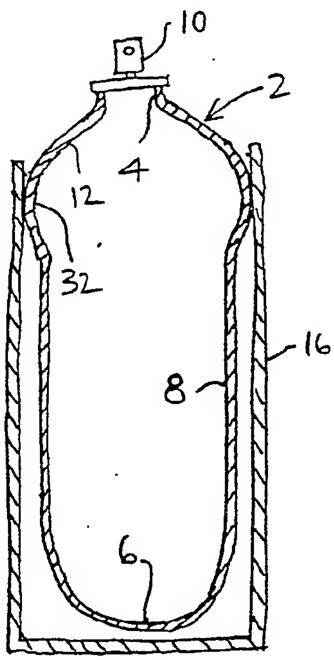

FIG. 7

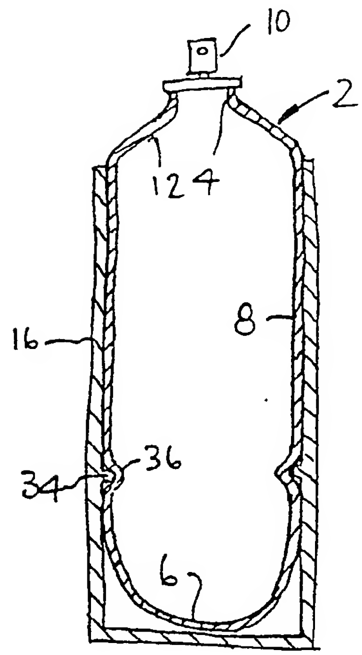

FIG. 8

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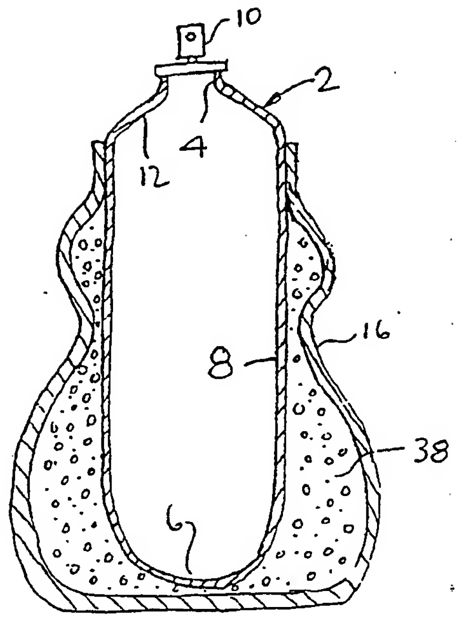

FIG. 9

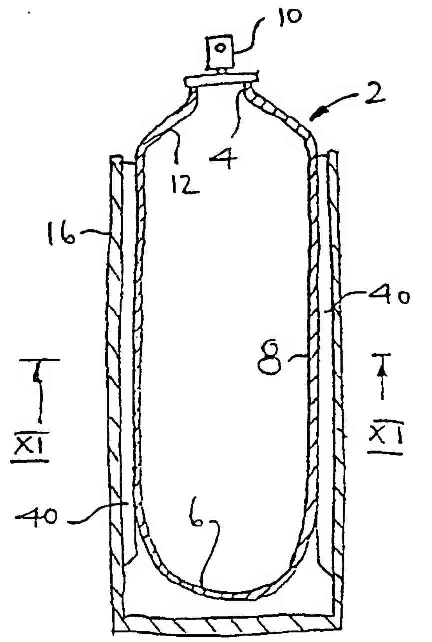

FIG. 10

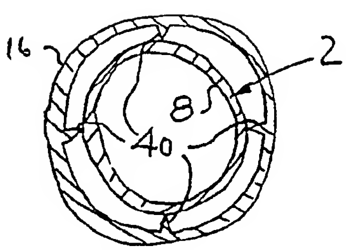

FIG. 11

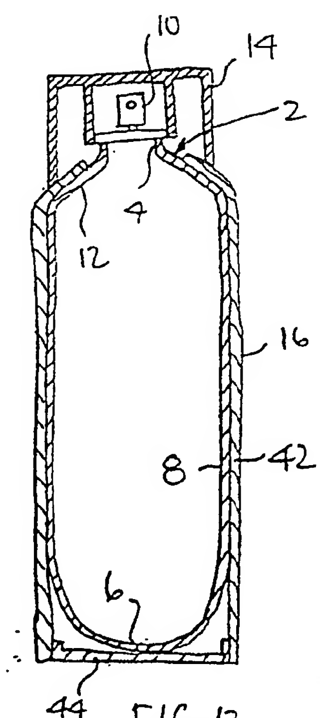

FIG. 12

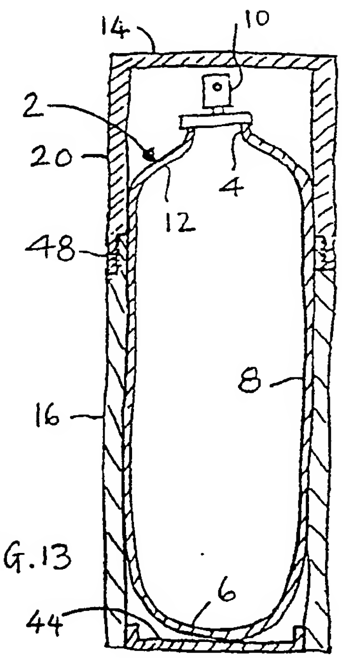

FIG. 13

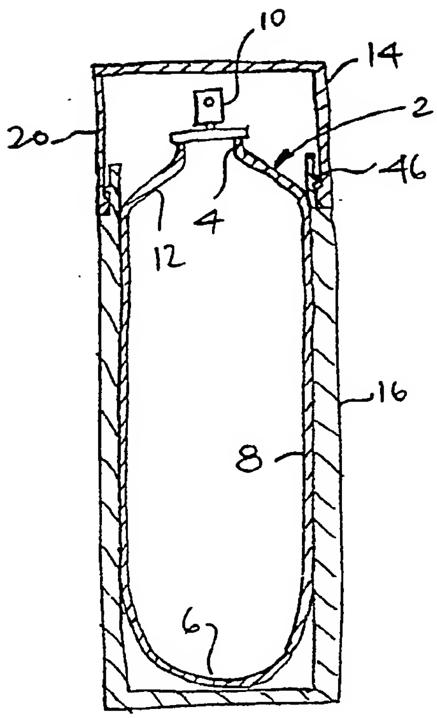

FIG. 14

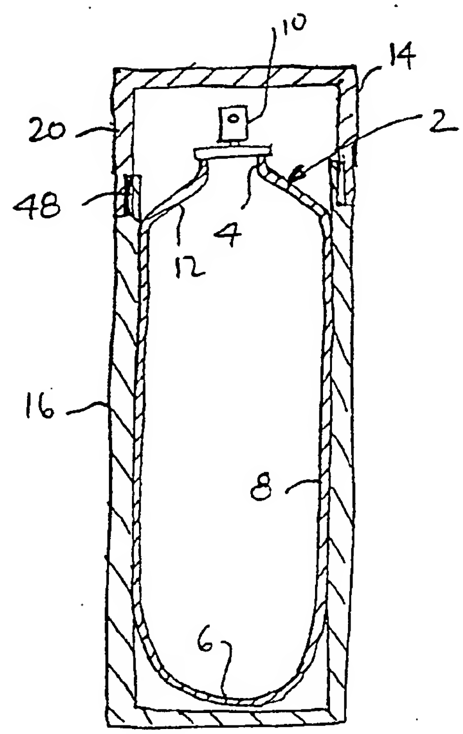

FIG. 15

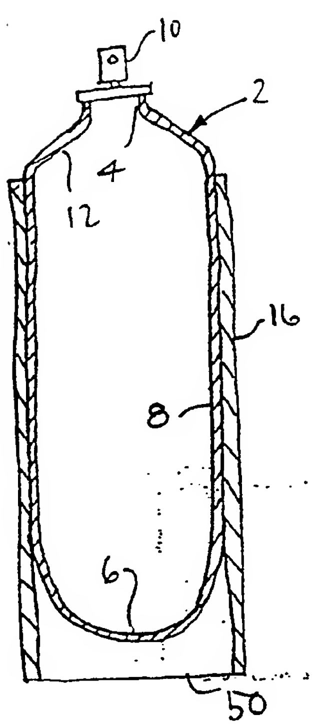

FIG. 16

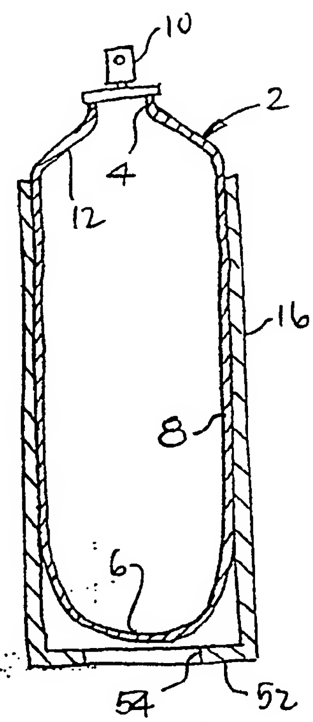

FIG. 17

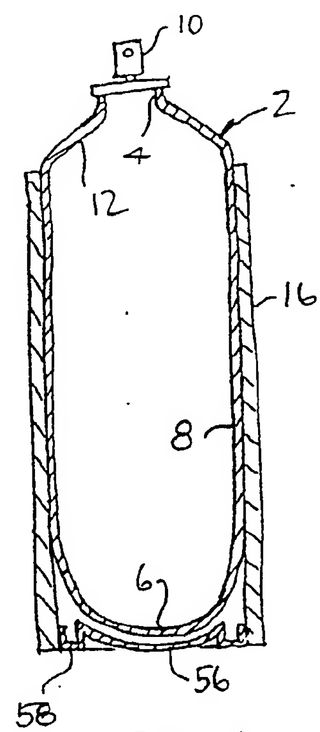

FIG. 18

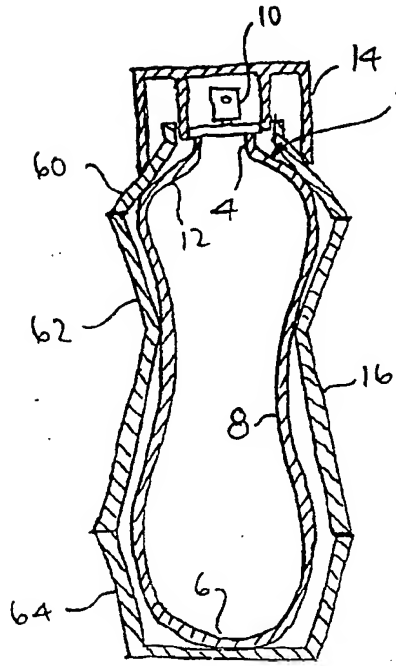

FIG. 19

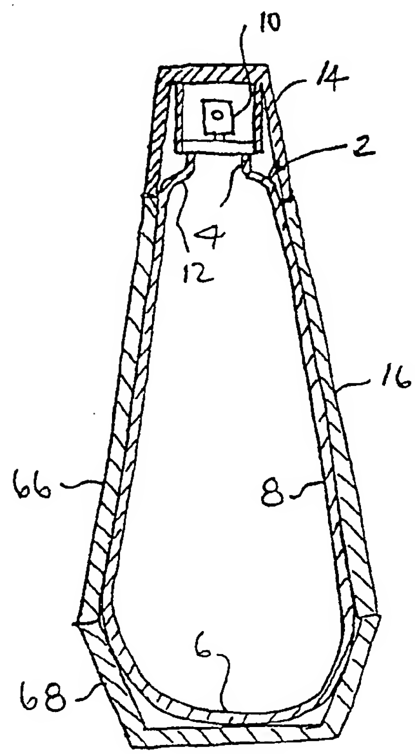

FIG. 20

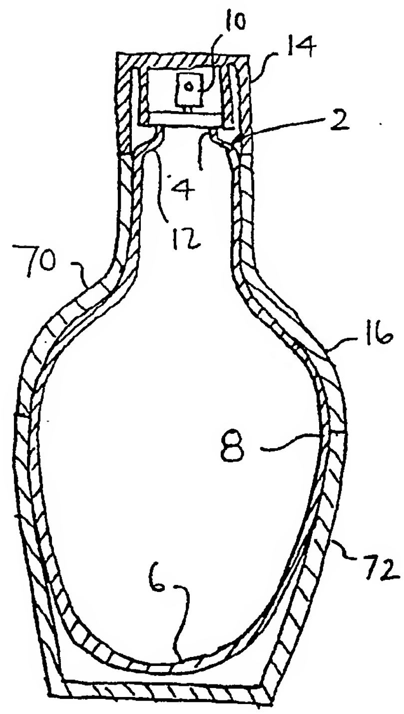

FIG. 21

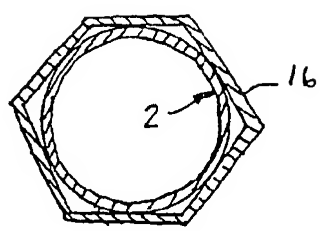

FIG. 22

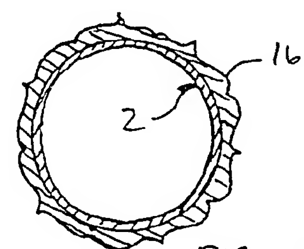

FIG. 23

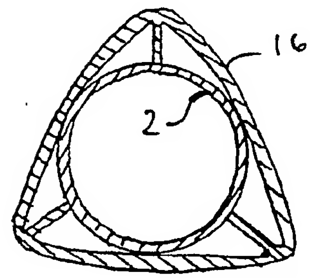

FIG. 24

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CONTAINER FOR PRESSURIZED MATERIALS

This invention relates to containers for pressurized materials, and is particularly, although not exclusively, concerned with aerosol containers.

For many years, aerosol containers have been made from metal. Recently, however, some aerosol containers have been made from stretch blow-moulded plastics material, such as polyethylene terephthalate (PET). The stretch blow-moulding process orients the plastics material both axially and circumferentially of the container, and this gives the container the ability to withstand internal pressure.

Although it is possible to form stretch blow-moulded containers which are able to stand, without adaptation, on a flat surface, the maximum resistance to internal pressure is achieved if the container has an outwardly convex, usually hemispherical, base region, which is clearly not capable of providing a stable support for the container. Consequently, such containers are usually provided with a separately formed base cup, which fits over the convex base region of the container to provide a stable support.

In attempts to improve the appearance of a stretch-blow moulded aerosol container provided with a base cup, the hemispherical base region of the container has been stepped slightly inwardly from the side wall immediately above it, in order to provide an approximately flush external surface at the transition between the base cup and the side wall of the container. However, there are limits to the sharpness of any step which can be achieved in a stretch blow-moulding process, and consequently it is impossible to avoid a pronounced visible line at the junction between the base cup and the side wall. For the same reason, it is difficult to achieve an aesthetically pleasing transition between the container side wall and a cap

fitted over the valve mechanism of the aerosol. For some aerosol applications, for example where they are used for packaging and dispensing cosmetic products of relatively high value, the discontinuity at the transition between the base cup and the side wall of the container has been regarded as aesthetically unacceptable.

Another disadvantage of current stretch blow-moulded plastics aerosol containers is that the possibilities for surface decoration are severely limited. The plastics materials used for stretch blow-moulded containers, particularly PET, are very costly, and consequently there is a strong incentive to reduce the wall thickness of the container as far as possible. This virtually eliminates any possibility of applying surface texture to the container by way of embossing or other surface treatments, because this would either locally reduce the wall thickness of the container to unacceptable levels, or require uneconomically large wall thicknesses which, in any case, are difficult to produce if the material is to be oriented. Furthermore, the stretch blow-moulded material is strain hardened, and is therefore not amenable to embossing since small radii are difficult, or impossible, to achieve. Also, the internal pressure in an aerosol tends to cause the side wall to assume a circular cross-section, so evening out any profiles applied to the side wall.

According to the present invention, there is provided a container for pressurized materials, comprising an inner vessel formed from plastics material by stretch blow-moulding, the inner vessel having a neck region at one end, a base region at the opposite end, and a side wall extending between the neck and base regions, a substantial portion of the side wall being enclosed within an outer sleeve of

rigid material which is secured to the vessel.

The outer sleeve may be provided on the side wall in abutment with the upper edge of a base cup fitted over the base region. In a preferred embodiment, however, there is no separate base cup, but the outer sleeve projects beyond the base region to provide a stable support for the container. The lower end of the outer sleeve may be wholly or partially closed by a transverse partition, which may be provided with appropriate formations to improve the stability of the container.

The outer sleeve may be a close fit over the inner vessel when the inner vessel is unpressurized. However, pressurization of the inner vessel usually causes it to expand radially, particularly when the wall thickness of the inner vessel is small in order to reduce the weight of plastics material required in its manufacture. Furthermore current standards require aerosol containers to be subjected to the so-called "water bath" test during which the contents are raised to their equilibrium vapour pressure at 50°C, and further radial expansion will occur during this test. In these circumstances, it may be preferable for the outer sleeve to fit over the inner vessel with some clearance when the inner vessel is unpressurized, the inner vessel then being expanded into firm engagement with the outer sleeve when its contents are pressurized and when the container is subjected to the water bath test. Alternatively, a clearance between the outer sleeve and the inner vessel may be maintained even when the inner vessel is pressurized, this clearance then being filled with, for example, bonding agent for securing the outer sleeve to the vessel.

In preferred embodiments, substantially the entire surface of the side wall of the vessel is covered by the outer sleeve. In some cases, however, it may be

desirable for only part of the side wall to be covered. For example, where the outer sleeve projects beyond the base region of the inner vessel to provide a stable support, the outer sleeve may terminate only a short way up the side wall, leaving the remainder of the side wall exposed. Possibly, such a container could be provided with an elongated cap which fits over the inner vessel to cover the area of the side wall left exposed by the outer sleeve. In such circumstances, for example, the outer sleeve may extend over 20% of the length of the side wall, although it is envisaged that, in most cases, the outer sleeve will extend over at least 50%, and probably more than 75%, of the total length of the side wall.

As mentioned above, the container may be provided with a cap, and preferably the cap abuts the top edge of the outer sleeve in order to provide a flush outer surface. Where the neck region of the inner vessel is connected to the side wall by a shoulder region, the junction between the cap and the outer sleeve may be substantially at the transition between the shoulder region and the side wall. The outer sleeve may be provided with appropriate formations, for example projections or recesses, or screwthreads, for receiving the cap in a secure manner. In some circumstances, however, the outer sleeve may project upwardly beyond the shoulder region.

The outer sleeve may have an external shape which is different from that of the inner vessel. For maximum resistance to internal pressure, the side wall of the inner vessel will normally be cylindrical with a circular cross section. However, the outer sleeve may have different external shapes, for example it may be polygonal in cross-section or have surface formations. Furthermore, the outer sleeve may vary in diameter along its length.

The outer sleeve may comprise an integral, one-piece component, for example formed from plastics material by injection moulding. Alternatively, the outer sleeve may be assembled from two or more components. The material of the outer sleeve may, for example, be high density polyethylene, polypropylene, polystyrene, nylon, PET, copolyesters or Selar PT (Trade Mark of Dupont), which is impact modified PET.

The outer sleeve may be secured to the inner vessel merely by virtue of the tight fit between these two components. However, it is preferable to provide some additional securing means. For example, the outer sleeve could be secured to the inner vessel by the use of adhesives or by welding. Alternatively, or in addition, some mechanical securing means may be provided. Thus, the outer sleeve may be provided with an internal bead or rib for engagement with the inner vessel, possibly in a recess formed in the inner vessel. Alternatively, one or more annular gaskets may be provided between the inner vessel and the outer sleeve in order to provide a reliable friction fit. In another embodiment, the inner vessel may be provided with a projecting region which makes firm contact with the outer sleeve. In yet another embodiment, which is particularly appropriate where the outer sleeve has a significantly different shape from the inner vessel, so that a void is left between the outer sleeve and the inner vessel, the void may be filled with a gap filling adhesive or a foamed plastics material. Alternatively, the outer sleeve may be provided with projections which extend across the void into contact with the inner vessel. The projections may, for example, be in the form of longitudinal ribs.

The provision of the outer sleeve not only enables the visual appearance of the container to be improved, either by eliminating any base cup, or by providing a

flush fitting between the base cup and the outer sleeve, and by enabling a flush fitting to be achieved between the outer sleeve and the cap, but also provides greater flexibility for surface printing and texturing of the container as a whole. Furthermore, the outer sleeve, being made from a rigid material, provides significant resistance to damage of the container. Thus, the outer sleeve protects the inner vessel from puncturing or bursting, for example when dropped. Because of this improved protection, it is possible to reduce the weight of material used in the manufacture of the inner vessel, thus economising on the expensive plastics material used in the stretch blow-moulding process. Also, the outer sleeve can improve the barrier properties of the container as a whole, for example by shielding the contents from light, or by preventing permeation of, for example, water or oxygen into the container to degrade the contents. Similarly, the outer sleeve can reduce the migration of components from the container.

For a better understanding of the present invention, and to show how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figures 1 to 10 and 13 to 21 are diagrammatic longitudinal sectional views of different embodiments of aerosol container;

Figure 11 is a sectional view taken on the line XI-XI in Figure 10; and

Figures 22 to 24 are diagrammatic transverse sectional views of further embodiments of aerosol containers.

All of the embodiments shown in the drawings comprise an inner vessel 2 having a neck region 4, a base region 6 and a side wall 8 which interconnects the neck and base regions 4 and 6. The neck region 4 is

closed by a valve mechanism 10. The neck region 4 is connected to the side wall 8 by a shoulder region 12. In the embodiments of Figures 1 to 4, 12 to 15 and 19 to 21, a cap 14 is shown which fits over the valve mechanism 10. Although no such cap 14 is shown in Figure 5 to 10 and 16 to 18, the containers of those Figures would normally also be provided with a cap, for example one similar to that shown in Figure 1.

In all embodiments, the side wall 8 of the inner vessel 2 is at least partially enclosed by a rigid, self-supporting outer sleeve 16 which is secured to the inner vessel 2.

For the purposes of the following description, it is assumed that the inner vessel 2 is formed from PET in a stretch blow-moulding process, while the outer sleeve 16 is formed from plastics material in an injection moulding process.

In the embodiment of Figure 1, the base region 6 meets the side wall 8 at a smooth transition, with no step, and is of substantially hemispherical shape. A base cup 18 is secured to the base region 6, for example by means of an adhesive, or by welding, and terminates at an upper edge substantially at the level of the transition between the base region 6 and the side wall 8. The outer sleeve is cylindrical and is a close fit on the side wall 8. It extends from the top edge of the base cup 18 to substantially the level of the transition between the side wall 8 and the shoulder 12. The cap 14 has an internal cylindrical projection which is a friction fit on the valve mechanism 10 in order to retain the cap 14 on the container. The outer wall 20 of the cap abuts the upper end of the outer sleeve 16.

The outer sleeve 16 abuts the outer wall 20 of the cap 14 and the upper edge of the base cup 18 to provide a flush outer surface to the container as a whole. The

container thus has a clean external appearance with no readily discernible line between the outer sleeve 16 and the base cup 18 or (when the cap is fitted) between the outer sleeve 16 and the cap 14.

The embodiment of Figure 2 corresponds closely to that of Figure 1, except that the outer sleeve 16 is extended beyond the base region 6, and is closed at its lower end by a partition 22. There is no separate base cup such as the base cup 18 of Figure 1.

Figure 3 is a variant of the embodiment shown in Figure 2. In the embodiment of Figure 3, the outer sleeve 16 is shortened, and terminates at an upper edge 24 only a short distance up the side wall 8. The cap 14 has an extended outer wall 26 which, when the cap is in position, covers the region of the side wall 8 which is left exposed by the outer sleeve 16.

In all of the embodiments of Figures 1 to 3, the inner vessel 2 is shown as a close fit within the outer sleeve 16. However, the inner vessel 2 is relatively thin-walled (its wall thickness is shown exaggerated in the Figures), and so is subject to radial and axial expansion when its contents are pressurized. Figure 4 shows a variant of the embodiment of Figure 2 in which the inner vessel 2 is shown in solid outline in its unpressurized state, and in dotted outline in the pressurized state. It will be appreciated that the outer sleeve 16 is dimensioned so that the inner vessel 2, when unpressurized, fits within the outer sleeve 16 with some clearance. This clearance is taken up by the radial and axial expansion of the inner vessel 2 when it is pressurized.

The contact between the inner vessel 2 and the outer sleeve 16 may, in itself, be enough to keep the two parts securely fixed together. However, as shown in Figure 5, a circumferential bead 28 may be provided to enhance the securement of the outer sleeve 16 on the

vessel 2. Although a single bead 28 is shown in Figure 5, at the top edge of the outer sleeve 16, it will be appreciated that further integral beads may be provided at different positions along the outer sleeve 16.

Figure 6 shows an alternative means for securing the inner vessel 2 with respect to the outer sleeve 16, in which gaskets 30 are provided at intervals along the outer sleeve 16 for supporting the inner vessel 2 within the outer sleeve 16. The gaskets 30 may be made from rubber or other elastomeric material and may be bonded either to the outer sleeve 16 or to the inner vessel 2, or to both. In the embodiment of Figure 7, secure contact between the inner vessel 2 and the outer sleeve 16 is established by forming a bulge 32 on the inner vessel 2. In Figure 7 this bulge is shown adjacent the shoulder 12, but it could be provided at other positions along the inner vessel 2, and it could be provided at more than one position.

Figure 8 shows a circumferential rib 34 formed on the inside of the outer sleeve 16, which cooperates with a circumferential recess 36 formed on the inner vessel 2. In this embodiment, the inner vessel 2 is retained in the outer sleeve 16 by a snap-action.

Figure 9 shows an embodiment in which the outer sleeve 16 has a significantly different shape from the inner vessel 2. Thus, the outer sleeve 16 varies in diameter along its length, so that a void is formed between it and the inner vessel 2. This void is filled with a foamed plastics material 38, which is introduced into the void in a liquid form, and allowed to cure or set in situ. The foamed plastics material 38 bonds securely to the inner vessel 2 and to the outer sleeve 16, so as to fix these two components firmly together.

Figure 10 shows an embodiment in which the inner sleeve 16 is provided with longitudinal ribs 40 which firmly engage the side wall 8 of the inner vessel 2

both to secure the inner vessel 2 within the outer sleeve 16 and to centralise the inner vessel 2.

In the embodiment shown in Figure 12, the outer sleeve 16 extends not only over the side wall 8, but also over a portion of the shoulder 12. Thus, the cap 14, instead of abutting the top edge of the outer sleeve 16, abuts the outer surface of it at the region which extends over the shoulder 12.

It will be appreciated that, since the outer sleeve 16 is formed from a rigid plastics material, it is not possible to introduce the vessel 2 into the outer sleeve 16 from the top end, as is the case with all of the preceding embodiments. Instead, the outer sleeve 16 is formed in two parts, namely a wall portion 42 and an end plug 44. To assemble the container, the vessel 2 is inserted into the wall portion 42 from the lower end until the shoulder 12 abuts the inwardly sloping top end of the wall portion 42. The plug 44 is then inserted into the wall portion 42 and secured in position, for example by welding or by a clip-on feature.

Figure 13 shows an embodiment in which the outer sleeve 16 terminates at the top some distance below the shoulder 12 of the inner vessel 2. Thus, the outer sleeve 16 covers only approximately 75% of the length of the side wall 8. The cap 14 engages the outer sleeve 16 and is retained in position by cooperating formations, such as screwthreads 48. Although the embodiment of Figure 13 is shown as having a plug 44, as in the embodiment of Figure 12, the bottom of the outer sleeve 16 may take other forms, such as that shown in Figures 14 and 15.

In the embodiments of Figures 14 and 15, the outer sleeve 16 projects upwardly beyond the transition between the side wall 8 and the shoulder 12. The projecting portion is provided with appropriate

formations (for example an external circumferential bead 46 in Figure 14 and screwthreads 48 in Figure 15) for engagement with corresponding formations on the outer wall 20 of the cap 14. Thus, the cap can be fitted directly to the outer sleeve 16, without needing to engage the valve mechanism 10.

In most of the preceding embodiments, for example the embodiment shown in Figure 2, the outer sleeve 16 has a transverse partition 22 which serves to provide a stable support for the container when standing on horizontal surface. Figures 16 to 18 illustrate alternative forms of the outer sleeve 16, while retaining the ability to provide a stable support for the container.

In Figure 16, the outer sleeve 16 is an open-ended cylinder, and so terminates at an open lower end 50. In Figure 17, a transverse partition 52 is provided at the lower end of the outer sleeve 16, this partition 52 having a central opening 54. The embodiment of Figure 18 is similar to that of Figure 16, except that the open-end of the cylindrical outer sleeve 16 is closed by a plug 56, which is formed to provide an outer annular support face 58. As shown in Figure 18, the plug 56 is spaced from the vessel 2 and is secured to the outer sleeve 16 by welding or with a snap fit. Alternatively, the plug 56 could be secured to the base 6 of the vessel 2, the outer sleeve 16 then being fitted over the combined vessel 2 and plug 56, perhaps after the vessel 2 has been filled and pressurized.

Figures 19 to 21 show embodiments in which the side wall 8 of the inner vessel is not cylindrical. These embodiments serve to demonstrate the variations in shape which can be achieved with containers in accordance with the present invention.

In Figure 19, the inner vessel 2 is waisted. The outer sleeve 16 is similarly waisted, although it is

formed of frustoconical portions, rather than being a continuous curve like the inner vessel 2. The outer sleeve 16 is formed from a top section 60, a middle section 62, and a base section 64. These sections are joined together, for example by welding or by snap fitting, after they are position over the inner vessel 2. Although the minimum diameter of the central portion 62 is smaller than the largest outer dimension of the inner vessel 2, it can be fitted over the inner vessel 2 by deforming the vessel 2 before it is pressurized. If this is not possible, the central portion 62 can be formed in two or more parts which can be assembled around the inner vessel 2.

Figure 20 shows a two-part outer sleeve 16, comprising an upwardly tapering top portion 66, which engages a correspondingly-shaped side wall 8, and a downwardly tapering base portion 68.

Figure 21 shows a somewhat "bottle-shaped" container in which, as in Figure 20, the outer sleeve 16 is formed from two portions which are interconnected after fitting them to the inner vessel 2. These portions are an upper portion 70 and a base portion 72.

Figures 22 to 24 demonstrate that the external shape of the outer sleeve 16, as seen in cross-section, need not be the same as that of the inner vessel 2. In Figure 22, the outer sleeve 16 has a hexagonal shape, although it will be appreciated that other polygonal shapes could be employed. Figure 23 shows external shaping of the outer sleeve 16 to produce a desired texture, and it will be appreciated that elaborate surface patterns, such as fluting, can be achieved. Figure 24 shows an outer sleeve 16 having a triangular shape with somewhat curved sides. Projections 74 extend from the apices of the triangular shape to engage the inner vessel 2 in order to secure the inner vessel 2 firmly within the outer sleeve 16.

CLAIMS

1. A container for pressurized materials, comprising an inner vessel formed from plastics material by stretch blow-moulding, the inner vessel having a neck region at one end, a base region at the opposite end, and a side wall extending between the neck and base regions, a substantial portion of the side wall being enclosed within an outer sleeve of rigid material which is secured to the vessel.

2. A container as claimed in claim 1, in which the outer sleeve abuts against a separate base cup applied to the base region of the inner vessel.

3. A container as claimed in claim 1, in which the outer sleeve projects beyond the base region to provide a stable support for the container.

4. A container as claimed in claim 3, in which the lower end of the outer sleeve is wholly or partially closed by a transverse partition.

5. A container as claimed in claim 4, in which the transverse partition is provided with formations to improve the stability of the container.

6. A container as claimed in any one of the preceding claims, in which the outer sleeve is a close fit on the side wall of the inner vessel.

7. A container as claimed in any one of claims 1 to 5, in which there is some clearance between the outer sleeve and the side wall of the inner vessel.

8. A container as claimed in claim 7, in which the clearance between the outer sleeve and the inner vessel contains a filling material.

9. A container as claimed in claim 8 in which the filling material is a bonding agent.

10. A container as claimed in claim 8 in which the filling material is foamed plastics material.

11. A container as claimed in any one of the preceding claims, in which the external shape of the

outer sleeve is different from that of the inner vessel.

12. A container as claimed in any one of the preceding claims, in which the outer sleeve is polygonal in cross section.

13. A container as claimed in any one of the preceding claims, in which the outer sleeve has surface formations.

14. A container as claimed in any one of the preceding claims in which the outer sleeve varies in diameter along its length.

15. A container as claimed in any one of the preceding claims, in which the outer sleeve terminates only a short way up the side wall of the inner vessel.

16. A container as claimed in claim 15, in which the outer sleeve extends from the base region over approximately 20% of the length of the side wall.

17. A container as claimed in any one of claims in which the outer sleeve terminates substantially at the transition between the side wall and a shoulder region, which connects the neck region of the inner vessel to the side wall.

18. A container as claimed in any one of claims 1 to 14, in which the outer sleeve projects upwardly beyond the shoulder region.

19. A container as claimed in any of the preceding claims, further comprising a cap.

20. A container as claimed in claim 19 in which the cap engages the top edge of the outer sleeve.

21. A container as claimed in claim 19, in which the cap and the outer sleeve provide a flush outer surface.

22. A container as claimed in any one of claims 19 to 21 when appendant to claim 15 or 16, in which the region of the side wall not covered by the outer sleeve is enclosed by the cap.

23. A container as claimed in any one of claims 19 to 22, in which the outer sleeve and the cap have cooperating formations for retaining the cap with the outer sleeve.

24. A container as claimed in claim 23, in which the formations provide a snap fit between the cap and the outer sleeve.

25. A container as claimed in claim 23, in which the formations are screwthreads.

26. A container as claimed in any one of the preceding claims, in which the outer sleeve is assembled from two or more components.

27. A container as claimed in any one of the preceding claims, in which the outer sleeve is formed from plastics material.

28. A container as claimed in claim 27, in which the outer sleeve is formed by injection moulding.

29. A container as claimed in claim 27 or 28, in which the plastics material is a high density polyethylene, polypropylene, polystyrene, nylon, polyethylene terephthalate, or a copolyester.

30. A container as claimed in any one of the preceding claims, in which the outer sleeve is secured to the inner vessel by frictional engagement between the outer sleeve and the inner vessel.

31. A container as claimed in any one of claims 1 to 29, in which the outer sleeve is secured to the inner vessel by welding.

32. A container as claimed in any one of claims 1 to 29, in which the outer sleeve is secured to the inner vessel by an adhesive.

33. A container as claimed in any one of the preceding claims, in which mechanical securing means is provided between the inner vessel and the outer sleeve.

34. A container as claimed in claim 33, in which the mechanical securing means comprises an internal

bead or rib, provided on the outer sleeve, for engagement with the inner vessel.

35. A container as claimed in claim 34, in which the internal bead or rib engages with a recess formed in the inner vessel.

36. A container as claimed in claim 33, in which the mechanical securing means comprises one or more annular gaskets which frictionally engage the inner vessel and the outer sleeve.

37. A container as claimed in claim 33, in which the mechanical securing means comprises a projecting region provided on the inner vessel, which makes firm contact with the outer sleeve.

38. A container for pressurized materials substantially in accordance with any embodiment described herein with reference to, and as shown in, the accompanying drawings.

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